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# THE INSTITUTES OF THE DEPARTMENT OF BIOLOGICAL SCIENCES PREPARE FOR THE DECEMBER PLENUM OF THE CENTRAL COMMITTEE OF THE COMMUNIST PARTY OF THE SOVIET UNION

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# THE INSTITUTES OF THE DEPARTMENT OF BIOLOGICAL SCIENCES PREPARE FOR THE DECEMBER PLENUM OF THE CENTRAL COMMITTEE OF THE COMMUNIST PARTY OF THE SOVIET UNION

[Following is a translation of an article by A. Ozol in Izvestiya Akademii nauk Latviyskoy SSR (Bulletin of the Academy of Sciences of the Latvian SSR), No. 11 (148), 1959, Riga, pages 5-10.]

In the decisions of the Twenty-First Congress of the CPSU concerning the seven-year plan for the development of the Soviet national economy, great objectives were set for biological science, in particular for biochemistry, biophysics, physiology, agricultural chemistry, genetics, and other branches of the biological disciplines.

In accordance with this, the Institute of Biology and the Institute of Microbiology of the Academy of Sciences of the Latvian SSR are working on a number of important problems and questions of current importance for our agriculture.

The Institute of Biology is doing research on the biological role of trace elements in agriculture, as well as on the biological principles involved in increasing crop production; on studying and mapping vegetation; on studying the physiological and biochemical role of substances which promote growth, increase size, promotion propagation, and increase the productivity of domestic animals and poultry; on studying the harmful and beneficial groups of animals; and on developing measures to increase fish production in inland waters.

The Laboratory of Soil Biochemistry and Trace Elements is studying the biological role of trace elements and their application in agriculture.

Trace elements, as we know, are component parts of enzymes, vitamins, and hormones and thus take part in the biochemical processes which occur in plant and animal organisms. When plants are fertilized with trace elements, there is not only a greater yield but an improvement in crop quality.

It has been determined that trace elements must be used in accordance with soil properties, the presence of assimilable forms of trace elements in the various soils, the physiological features of the different soils and crop varieties, and the microbiological processes which take place in soils. For this reason it is exceptionally important to have maps of the available trace element content of soils.

At the Laboratory of Soil Biochemistry and Trace Elements a field laboratory has been designed for determining trace elements in soils.

The study of the biological role of individual trace elements has established the exceptionally important role of boron in protein and carbohydrate metabolism, in fertilization processes in plants, and in increasing the resistance of plants to bacterial diseases (bacteriosis of flzx, heart rot of sugar beets).

A particularly important role is played by boron in the liming of acid podzol soils. Experiments have shown that turf-podzol soils require an extensive liming with boron fertilizers for legume, forage, industrial, and oilseed crops.

Boron fertilizers are now recommended for use in increasing the yield of flax, clover, alfalfa, sugar beets, the various vegetable crops, and the fodder root crops. Boron contributes to a greater yield of clover and alfalfa seed, which is of particular importance in supplying collective farms with seed for these legumes.

The trace element copper also takes part in the oxidation processes of plant cells and is a component of the oxidase enzymes. Where there is a copper deficiency, the activity of these enzymes is considerably reduced. Copper also affects the carbohydrate and protein metabolism of plants and intensifies respiration. A major role has been established for copper fertilizers in increasing the yield of a number of crops on swampy and other soils having insufficient copper available for plants. In peat and certain sandy soils of the podzol zone there is an absolute deficiency of copper, so that the use of copper fertilizers is obligatory.

As shown by experiments at the Laboratory of Soil Biochemistry, pyrite cinders greatly increase crop yields in soils poor in copper. The yield of grain crops, for instance, shows an average increase of 4-7 centners per hectare.

When copper fertilizers are applied, flax may be grown even in swampy soils. We have also detected the great effectiveness of copper in swampy soils when used in growing hemp and seed plants of the perennial grasses, as well as fodder and vegetable crops.

Manganese is found in a number of enzymes and plays a major role in plant respiration and photosynthesis. Manganese increases the intensity of plant respiration and the assimilation of carbon dioxide.

Manganese fertilizers are being successfully used in neutral soils containing little manganese available to plants.

Highly effective as manganese fertilizers for various crops are both manganese sulfate and the waste obtained from the processing of manganese ores. Of the greatest practical importance is manganese slag and other industrial wastes which contain manganese.

Zinc is a component of many enzymes and participates in the biochemical processes which take place in plants and the animal organism. Zinc has a positive effect on the yield of grain, clover, vegetables, and other crops. It is desirable that zinc solutions be used to treat corn and other seeds before sowing.

Extremely responsive to applications of molybdenum are the legumes, which contain considerably more of this element than the plants of other families.

Molybdenum is particularly effective on acid soils which contain much free aluminum and manganese. It has been determined that molybdenum facilitates protein synthesis and a better utilization of nitrogen and phosphorus by plants. The yield of lgeumes increased 40-50% following the application of molybdenum. Molybdenum fertilizer can be used for foliar fertilization and seed treatment. In the Laboratory of Soil Biochemistry and Trace Elements the great effectiveness of molybdenum from a number of industrial wastes of the Urals and other regions of the USSR has been established.

The problem of using trace elements is of national importance. Practical coordination in this matter is being effected by the Laboratory of Soil Biochemistry and Trace Elements of the Academy of Sciences of the Latvian SSR.

The plan for the laboratory calls for a study of the physiological and biochemical role of trace elements; the effect of trace elements on various enzymatic processes in the plant organism; and on the behavior, distribution, and functions of trace elements in the plant organism.

Physiological and genetic research aimed at increasing the production and resistance of crops has yielded a number of substantial results. During recent years extensive research has been done on detecting the most promising varieties of fruit developed by popular breeding and adapted to local winter conditions. Of great importance in this question are winter hardiness, productivity, and fruit quality. During this time a total of more than 400 seedlings and clones of local varieties developed by popular selection have been detected and studied. Forty-two varieties have been designated as promising (26 apple, 5 pear, 7 plum, and 4 sweet cherry) from which the Latvian Pomological Commission has included 11 varieties in the standard assortment (3 apple, 3 pear, 2 plum, and 3 sweet cherry).

Certificates have been given for 19 popularly developed varieties (8 apple, 4 pear, 4 plum, and 3 sweet cherry) to the State Commission on Crop Testing of the Soviet Ministry of Agriculture. These varieties will be put through state crop tests.

In the future (1960-1965) work is to be completed on studying and propagating the most promising varieties of popularly developed fruit crops. Work is to be expanded on studying biochemical and physiological factors in the winter hardiness of fruit, decorative, and other crops which live through the winter, as well as on working out methods for determining the winter hardiness of plants and on discovering the physiological effect of supplementary fertilizers and training methods which assure greater winter hardiness in farm crops, apples, plums, sweet cherries, grapes, hazelnut, and others. Tagged atoms will be used extensively in this research. The results of these studies will be of great importance for predicting the winter hardiness of crops, as well as for developing measures to assure greater winter hardiness in these plants.

Considerable work has been done recently on the clonal selection of potatoes and studying the hybrid collection of Michurin's disciple P. D. Knappe with an evaluation and propagation of promising numbers for production. The vegetative hybridization method has been used to derive the Jaunvale potato, a new high-yield and disease-resistant hybrid.

From the experimental hybrid stock three canker-resistant hybrids will be selected for testing in the state variety testing system and in production. It is planned to do genetic and breeding research on potatoes, vegetables, and certain grain crops for the purpose of increasing the resistance of these plants to frost, disease, pests, and for shortening the vegetative period and increasing the yield. Work will be done with the aim of discovering the effect of ionizing radiation, and certain other physical and chemical factors on variations in the properties required by production and breeding and on the qualities of experimental crops.

The plan also calls for an extension of research on the effect of the physiologically active chemical compounds synthesized by the Institute of Organic Synthesis of the Academy of Sciences, and on developing practical methods for utilizing these compounds as herbicides and growth promoting substances.

Of great importance is the study and mapping of vegetation in the Republic. The study of the vegetation in the Republic with the compilation of a geobotanical map on a 1:200,000 scale has been started on assignment from the Republic agencies. This work is of current importance in connection with soil surveys and an economic evaluation of the lands of the collective and state farms. It is being done in conjunction with the Agricultural Institute of the Ministry of Agriculture of the Latvian SSR.

Studies on the physiological and biochemical role of trace elements, vitamins, and antibiotics in growth stimulation, reproduction, and productivity in animals and poultry have produced a number of positive results. In Conjunction with the Institute of Stockbreeding of the Latvian SSR, the Riga Feed Plant has started preparing experimental batches of feed based on a new formula, fortified with vitamins, antibiotics, and trace elements.

During recent years approximately 1,500 tons of enriched feeds have been prepared and tested. Laboratory and field tests of feeds on the collective, state, and experimental farms of the Republic have revealed the great economic effectiveness of these feeds.

Weight increases in bacon hogs and calves fed on these feeds were up 15-25%, and in chickens up 15-20%, as compared with control animals given unenriched feeds; milk yields increased 10-15% and egg production 5-10%.

By the end of 1965 the Republic will have the regular production of vitamin enriched feeds, antibiotics, and combined preparations in quantities sufficient to meet livestock needs.

The realization of these measures will make it possible to reduce disease among the Republic's livestock and poultry, increase their productivity, accelerate the fattening period for hogs, and effect great savings in feed consumption. The extra profit obtained from stock-breeding as a result of these measures will amount to approximately 250,000,000 rubles.

Zoological research at the Institute is aimed at studying harmful and beneficial groups of animals, and at developing measures to protect plants and control helminth diseases in animals.

Studies have been made of the different species, biology, ecology, and morphology of a number of insects (sawflies, June beetles and May beetles, click beetles, butterflies, and Diptera) which are hamful to crops, and this has made it possible to improve control measures.

Instructions have been drawn up and measures are being adopted for controlling plum sawflies and the apple fruit miner.

A study is being made of the parasite pests of fruit and vegetable crops with the aim of developing biological control measures. Experimental work is being done on the use of Trichogrammatidae to control the white cabbage butterfly and the codling moth.

In addition, studies are being made on the ecology and metamorphosis of the onion fly and the onion syrphus and the question of new insecticides to control these pests is being studied.

A study has been made of the regional distribution and seasonal and age dynamics of Moniezia infestations, and proposals have been worked out and adopted for worming livestock.

There is a plan for further study of clinical aspects of the early stages of ascariasis in pigs for purposes of early diagnosis, which will make it possible to effect pre-imago worming and the elimination of this disease.

Studies are being made on the epizootology of Dictyocaulus infestations of sheep. The results of this research will be used in drawing up a scientifically based plan of measures to control this infestation.

A study has started on the courses of the transmission of coccidiosis in chickens. As a result, recommendations will be formulated for preventing this disease through the use of various new drugs.

The Institute is doing extensive research on developing measures to increase fish production in inland waters. On the basis of studies made of the fish species and stocks and their food supply, measures have been developed and are being put into practice for increasing the fish production of the principal commercially important lakes of the Republic.

The use of a combined system of fertilization for ponds of the swamp type as developed by the Institute is making it possible to increase production to 656-775 centners per hectare in Latvia ("Rita Ausma" Pond Farm in Ayzpute District).

The plan for further increasing fish production in lakes and pond farms calls for research on the acclimatization of valuable whitefish, on the genetics and breeding of carp, and the development of efficient means for increasing the number of good fish in natural waters by eradicating the poorer and valueless varieties and by improving the feed supply.

The Institute of Microbiology of the Latvian Academy of Sciences is doing extensive research on soil microbiology. It is directed at studying the problems connected with increasing crop yields.

Through selection from local soil races and controlled variation in their properties, active forms of azotobacter have been obtained which are adpated to the local soil and climatic conditions and manifest good survival on plant roots when introduced in the form of bacterial fertilizer. Two specific strains of azotobacter have been obtained: No. 47 for barley and No. 48 for oats. In addition, strain No. 50 has been isolated from acid turf-podzol soil (pH 5.3): it survives in the rhizosphere of oats, barley, spring wheat, and flax and contributes to a 10-15% increase in yield.

Of great importance are studies on the selection of local active races of tubercle bacteria of alfalfa and lupine which flourish on plant roots and give a positive effect in the presence of natural tubercle bacteria. For instance, in a field test at the "Pamava" school farm of the Latvian Agricultural Academy, under natural inoculation (with natural bacteria) a yield of 206 centners per hectare of lupine tops was obtained; with inoculation by commercial nitragin, 239 centners per hectare; and with inoculation with the local active race B-08, a yield of 250 centners per hectare. A still greater yield increase was obtained in experiments on the "Rimeykas" experimental farm of the Latvian Stockbreeding Institute, where the soil contained no natural lupine tubercle bacteria. Control plantings produced 105 centners per hectare, and those inoculated with race B-08 produced 277 centners per hectare.

Four active and virulent strains of clover tubercle bacteria (Nos. 3, 58, and 9) have been isolated and flourish in turf-podzol soils, dominating over the natural tubercle bacteria in the formation of tubercles. These strains give 60-100% of the total number of tubercles formed on clover roots and produce an additional yield (under field conditions) of 9-20%.

The results of the effective use of baterial fertilizers in applications to treated seeds have made it possible to work out a method for the application of bacteria to treated seeds for use in farm production.

In 1959 the laboratory used local active strains to produce batches of bacterial fertilizer sufficient for 15,000 hectares and turned it over for the spring sowing. Research is also being done on the effect of trace elements on the root microflora of plants and on nitrogen-fixing bacteria.

The research plan of the Institute also includes the study of the bacterial diseases of vegetable crops and the study of the bacteriophages of the microorganisms which cause these diseases. The study of these problems aims at finding biological agents for controlling the bacterial diseases of vegetables.

In addition, the Institute of Forestry Problems and Wood Chemistry of the Latvian Academy of Sciences is doing valuable research on current problems of forest management in collective-farm forests and on the introduction into forest plantations of valuable new fast-growing tree varieties (larch, poplar, alder hybrids, etc.).

The Botanical Garden of the Latvian Academy of Sciences is doing work on the breeding of new flowering plants and on the introduction of beautiful new flowering trees and shrubs into landscape gardening.

The objectives of workers in the field of biology are great and honorable. The duty of each of us is to carry through the historic decisions of the Twenty-First Congress of the CPSU and the decision of the December Plenum of the Central Committee of the CPSU which will consider goals for a great new expansion of production in Soviet agriculture.

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